Amendments to the Specification:

Please replace the Summary of Invention section with the following rewritten section.

<div align="center">

<u>SUMMARY OF THE INVENTION</u>

</div>

The need in the art is addressed by the systems and methods of the present invention. In accordance with the invention, a method of fitting a plurality of sub-population functions to data is taught. The method comprises the steps of defining a plurality of functions according to a plurality of function parameters and a total number of functions and generating ~~an objective function~~ <u>a model</u> based on the plurality of function parameters. Then, determining ~~a fitting~~ <u>an objective function for fitting</u> error between the ~~objective function~~ <u>model</u> and the data and comparing the fitting error to stopping criteria, and determining if the fitting error does not satisfy the stopping criteria. Finally, altering the plurality of function parameters and the total number of functions, and repeating the generating, determining, and comparing steps.

In a refinement of the foregoing method, a further step is added which is specifying at least a first threshold value delineating the plurality of functions. In another refinement, the at least a first threshold value is calculated based upon the likelihood of misclassification of data. In another refinement, the step of segmenting the data according to the at least a first threshold value is added. In another refinement, the objective function is defined as a vector representation of the plurality of function parameters. <u>In another refinement the model is defined as a vector representation of the plurality of function parameters.</u> In another refinement, the altering step is accomplished by evolving the plurality of function parameters and the total number of functions according to a genetic algorithm. In another refinement, the genetic algorithm evolves the plurality of function parameters through mutation and crossover. In another refinement, the plurality of functions are normal distributions, and the plurality of functions parameters include the mean and standard deviations of the normal distributions. In another refinement, the comparing step includes the utilization of a statistical f-test to evaluate the relative contribution of each of the plurality of functions in comparison of the fitting error and the data. In another refinement, the data is organized as a histogram. In another refinement, the stopping criteria are defined by a fitness function. In another refinement, the fitness function is

optimized to minimize the magnitude of the fit error between the objective function and the data.

The present invention also teaches an apparatus for fitting a plurality of sub-population functions to data. That apparatus comprises a means for defining a plurality of functions according to a plurality of function parameters and a total number of functions and a means for generating ~~an objective function~~ a model based on the plurality of function parameters. In addition, a means for determining ~~a fitting~~ an objective function for fitting error between the ~~objective function~~ model and the data and a means for comparing the fitting error to stopping criteria, and wherein if the comparison determines that the fitting error does not satisfy the stopping criteria,. And, the apparatus is operable to effect a means for altering the plurality of function parameters and the total number of functions, and operable to repeat the generating, determining, and comparing operations.

In a refinement of the foregoing apparatus, it further comprising means for specifying at least a first threshold value delineating the plurality of functions. In another refinement, the at least a first threshold value is calculated based upon the likelihood of misclassification of data. In another refinement, the apparatus further comprises a means for segmenting the data according to the at least a first threshold value. In another refinement, the objective function is defined as a vector representation of the plurality of function parameters. In another refinement, the model is defined as a vector representation of the plurality of function parameters. In another refinement, the means for altering operation is accomplished by evolving the plurality of function parameters and the total number of functions according to a genetic algorithm. In another refinement, the genetic algorithm evolves the plurality of function parameters through mutation and crossover. In another refinement, the plurality of functions are normal distributions, and the plurality of functions parameters include the mean and standard deviations of the normal distributions. In another refinement, the means for comparing includes the utilization of a statistical f-test to evaluate the relative contribution of each of the plurality of functions in comparison of the fitting error and the data. In another refinement, the data is organized as a histogram. In another refinement, the stopping criteria are defined by a fitness function. In another refinement, the fitness function is optimized to minimize the magnitude of the fit error between the objective function and the data.

The present invention also teaches a specific application directed to the field of digital imaging. A method of specifying thresholds for segmenting a digital image is taught. That method comprises the steps of producing a histogram of the image, having histogram data and defining a plurality of functions according to a plurality of function parameters and a total number of functions. Then, generating ~~an objective function~~ a model based on the plurality of function parameters and determining ~~a fitting~~ an objective function for the fitting error between the ~~objective function~~ model and the histogram data. Next, comparing the fitting error to stopping criteria and altering the plurality of function parameters and the total number of functions, and repeating the generating, determining, and comparing steps if the fitting error does not satisfy the stopping criteria. Finally, specifying at least a first threshold value delineating the plurality of functions if the fitting error satisfies the stopping criteria.

In a refinement to the imaging method, the at least a first threshold value is calculated based upon the likelihood of misclassification of the histogram data. In another refinement, the objective function is defined as a vector representation of the plurality of function parameters. In another refinement the model is defined as a vector representation of the plurality of function parameters. In another refinement, the altering step is accomplished by evolving the plurality of function parameters and the total number of functions according to a genetic algorithm. In another refinement, the genetic algorithm evolves the plurality of function parameters through mutation and crossover. In another refinement, the plurality of functions are normal distributions, and the plurality of functions parameters include the mean and standard deviations of the normal distributions. In another refinement, the comparing step includes the utilization of a statistical f-test to evaluate the relative contribution of each of the plurality of functions in comparison of the fitting error and the data. In another refinement, the stopping criteria are defined by a fitness function. In another refinement, the fitness function is optimized to minimize the magnitude of the fit error between the objective function and the data.

The present invention also teaches an apparatus for determining thresholds for segmenting a digital image. The apparatus includes a means for producing a histogram of the image, having histogram data and a means for defining a plurality of functions according to a plurality of function parameters and a total

-4-

number of functions. Also, a means for generating an objective function based on the plurality of function parameters and a means for determining a fitting error between the objective function and the histogram data. Also, a means for comparing the fitting error to stopping criteria and a means for altering the plurality of function parameters and the total number of functions, and repeating the generating, determining, and comparing operations if the fitting error does not satisfy the stopping criteria. Finally, a means for specifying at least a first threshold value delineating the plurality of functions if the fitting error satisfies the stopping criteria.

In a refinement to the foregoing apparatus, the at least a first threshold value is calculated based upon the likelihood of misclassification of the histogram data. In another refinement, the objective function is defined as a vector representation of the plurality of function parameters. In another refinement, the altering operation is accomplished by evolving the plurality of function parameters and the total number of functions according to a genetic algorithm. In another refinement, the genetic algorithm evolves the plurality of function parameters through mutation and crossover. In another refinement, the plurality of functions are normal distributions, and the plurality of functions parameters include the mean and standard deviations of the normal distributions. In another refinement, the means for comparing includes the utilization of a statistical f-test to evaluate the relative contribution of each of the plurality of functions in comparison of the fitting error and the data. In another refinement, the stopping criteria are defined by a fitness function. In another refinement, the fitness function is optimized to minimize the magnitude of the fit error between the objective function and the data.

Please add the following paragraph on page 24 after line 7.

An objective-function can be defined as a vector representation of a plurality of function parameters.